

Serial No. 10/602,631

**IN THE CLAIMS:**

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

Please CANCEL claims 4 and 13, AMEND claims 1, 5, 9, 21, 22, 24, and 26, and ADD new claim 28 in accordance with the following:

1. (Currently Amended) A paper edge sensing apparatus in a printer having a pickup unit and a convey unit, the apparatus comprising:
  - a carrier;
  - a printer head mounted to the carrier;
  - a first paper sensor mounted between the pickup unit and the convey unit to detect a top edge and a bottom edge of a paper;
  - a second paper sensor mounted to the carrier a predetermined distance from the printer head, to detect a right edge, a left edge, the top edge, and the bottom edge of the paper, and
  - a controller controlling operations of the printer head
    - to control print margins of top and bottom ends of the paper by comparing first top edge and first bottom edge signals from the first paper sensor and second top edge and second bottom edge signals from the second paper sensor, and
    - to control print margins of right and left edges of the paper according to left and right edge detections signals of the second paper sensor

~~wherein a paper print margin comprises the predetermined distance between the second paper sensor and the printer head.~~

2. (Previously Presented) The apparatus of claim 1, wherein the second paper sensor comprises:
  - an optical sensor mounted in the carrier and having a light emitter emitting light, a light receiver receiving light, and a reflection surface to reflect light emitted from the light emitter to the light receiver.
3. (Original) The apparatus of claim 2, wherein the reflection surface is transversely arranged across the paper convey direction.

Serial No. 10/602,631

4. (Cancelled)

5. (Currently Amended) The apparatus of claim 41, wherein the predetermined distance is in a range between 0.5 to 1mm.

6. (Cancelled)

7. (Previously Presented) The apparatus of claim 1, wherein the first paper sensor comprises an optical sensor provided with a light emitter emitting light, a light receiver receiving light, and a sensor actuator rotatably mounted to the frame.

8. (Original) The apparatus of claim 1, further comprising:  
an encoder detecting a movement amount of the carrier.

9. (Currently Amended) A paper edge sensing method in a printer having a first paper sensor disposed between a pickup unit and a convey unit, and a second paper sensor mounted in a fixed position relative to a moving printer head, comprising:

detecting a top edge and a bottom edge of a sheet of paper using the first paper sensor to output a corresponding first top edge detection signal and a first bottom edge detection signal;

beginning counting a start print time interval and an end print time interval upon detection, by the first paper sensor, of the top and the bottom edge, respectively;

detecting the top edge and the bottom edge of the paper using the second paper sensor to output a corresponding second top edge detection signal and a second bottom edge detection signal;

detecting a left edge or a right edge of the sheet of paper when the second paper sensor moves transversely to at least one of the left edge or the right edge of the sheet of paper; and

generating a begin print command at a later of the start print time interval and the second top edge detection signal, and generating an end print command at a later of the end print time interval and the second bottom edge detection signal.

10. (Cancelled)

11. (Previously Presented) The method of claim 9, wherein the printer comprises a

Serial No. 10/602,631

controller and the method further comprises:

transmitting the first and second top edge detection signals and the first and second bottom edge detection signals to the controller;

counting the start print time interval and the end print time interval using the controller;

comparing the start print time interval to the second top edge detection signal and the end print time interval to the second bottom edge detection signal using the controller; and

controlling operation of the printer head based on a command from the controller.

12. (Original) The method of claim 9, wherein the printer comprises a pickup unit and a convey unit and further comprising:

controlling dynamic power switching from the pickup unit to the convey unit with the controller.

13. (Cancelled)

14. (Previously Presented) The method of claim 9, the printer comprising the second paper sensor and the printer head mounted to a movable carrier, and the method further comprising:

identifying a first detection signal as either of the first top edge detection signal or the first bottom edge detection signal if the first detection signal is generated when the carrier is located at an initial position in a central portion of a width of a sheet.

15. (Previously Presented) The method of claim 9, the printer comprising the second paper sensor and the printer head mounted to a movable carrier, and the method further comprising:

identifying a first detection signal as either a first right edge detection signal or a first left edge detection signal if the first detection signal is generated when the carrier is located outside of an initial position in a central portion of a width of the sheet.

16. (Original) The method of claim 9, the printer comprising a pickup unit and further comprising:

picking up the sheet to print thereon.

17. (Original) The method of claim 9, further comprising:

Serial No. 10/602,631

selecting a general print mode to place margins on the sheet.

18. (Original) The method of claim 9, further comprising:

selecting a borderless print mode such that no margins are placed on the sheet.

19. (Previously Presented) The method of claim 9, further comprising:

tracking a position of the second paper sensor.

20. (Original) The method of claim 9, further comprising:

externally discharging an image-printed sheet from the printer.

21. (Currently Amended) The apparatus of claim 1, wherein:

the controller determines a print start timing as a later of:

an estimated timing of the top edge reaching a print position proximate to the printer head based on the first top edge signal and a speed of the paper moving through the printer, and/or

the second top edge signal.

22. (Currently Amended) The apparatus of claim 1, wherein:

the controller determines a print stop timing as a later of:

an estimated timing of the bottom edge moving beyond a range of an upstream end of the printer head based on the first bottom edge signal and a speed of the paper moving through the printer, and/or

the second bottom edge signal.

23. (Previously Presented) The apparatus of claim 1, wherein the controller controls the printer head to print within the print margin, to achieve a borderless image on the paper.

24. (Currently Amended) A paper edge sensing apparatus for borderless printing in a printer having a pickup unit, a convey unit, a carrier, and a printer head connected with the carrier, the apparatus comprising:

a first paper sensor mounted between the pickup unit and the convey unit to detect a top edge and a bottom edge of a paper;

a second paper sensor connected with the carrier, to detect a right edge, a left edge, the

Serial No. 10/602,631

top edge, and the bottom edge of the paper; and  
a controller, using right and left edge signals from the second paper sensor and  
comparing first top edge and first bottom edge signals from the first paper sensor and second  
top edge and second bottom edge signals from the second paper sensor, to control the printer  
head to start and stop printing on the paper.

25. (Previously Presented) The apparatus of claim 24, wherein the controller controls  
the printer head to print on the entire paper, to achieve a borderless image on the paper.

26. (Currently Amended) A paper edge sensing apparatus in a printer, comprising:  
a carrier;  
a printer head mounted to the carrier;  
a first paper sensor mounted between a pickup unit and a convey unit to detect a top  
edge and a bottom edge of a paper;  
a second paper sensor mounted to the carrier a predetermined distance from the printer  
head and detecting the top edge, the bottom edge, and left and right edges of the paper; and  
a controller controlling operations of the printer head according to a comparison of  
signals from the first and second paper sensors,  
wherein a paper print margin comprises the predetermined distance between the first  
second paper sensor and the printer head.

27. (Previously Presented) A paper edge sensing method in a printer having a first  
paper sensor mounted between a pickup unit and a convey, and a second paper sensor  
mounted in a fixed position relative to a moving printer head, the method comprising:  
detecting a top edge and a bottom edge of a sheet of paper using the first paper sensor, to  
output a corresponding first top edge detection signal and a first bottom edge detection signal;  
detecting a top edge, a bottom edge, and at least one of left or right edges of the sheet of  
paper using the second paper sensor, to output a corresponding second top edge detection signal, a  
second bottom edge detection signal, and at least one of left or right edge detection signals;  
estimating a start print time based on the first top edge detection signal and generating a  
begin print command at a later of the estimated start print time and the second top edge  
detection signal;  
estimating an end print time based on the first bottom edge detection signal and  
generating an end print command at a later of the estimated end print time and the second

Serial No. 10/602,631

bottom edge detection signal; and

generating at least one of left or right edge print commands when the at least one of the left or right edges is detected.

28. (New) A paper edge sensing apparatus in a printer, comprising:

a carrier;

a printer head mounted to the carrier;

a first paper sensor mounted between a pickup unit and a convey unit to detect a top edge and a bottom edge of a paper;

a second paper sensor mounted to the carrier a predetermined distance upstream, with respect to a paper traveling direction, from the printer head, and detecting the top edge, the bottom edge, and at least one of left or right edges of the paper; and

a controller controlling operations of the printer head according to a comparison of signals from the first and second paper sensors.